1. A number is called *rational* if it is the quotient of two integers; otherwise it is called irrational. Prove that $\sqrt{3}$ is irrational. (Read the proof in the book that $\sqrt{2}$ is irrational.)

*Proof:* By contradiction. Assume $\sqrt{3}$ is rational. Then $\sqrt{3}$ can be written as $p/q$, where $p$ and $q$ are integers. The fraction can be reduced to the lowest terms, meaning that we can assume that the greatest common divisor of $p$ and $q$ is 1.

\[
\frac{p}{q} = \sqrt{3}
\]
\[
\frac{p^2}{q^2} = 3
\]
\[
p^2 = 3q^2
\]

Thus $p^2$ is divisible by 3.

Thus $p$ is divisible by 3.

Write $p = 3k$ where $k$ is an integer. Thus
\[
3q^2 = p^2
\]
\[
3q^2 = 9k^2
\]
\[
q^2 = 3k^2
\]

Thus $q^2$ is divisible by 3.

Thus $q$ is divisible by 3.

Thus 3 is a common divisor of $p$ and $q$, contradicting the fact that they are relatively prime. $\blacksquare$


\[L(G) = \{(ab)^n : n \geq 0\}\]

Or, work Exercise 15 on page 29 of the sixth edition.

\[L(G) = \{(aab)^n : n \geq 0\}\]

Work Exercise 13 of page 38 of the fifth edition, which is Exercise 16 on page 29 of the sixth edition.

\[L(G) = \emptyset \text{ (the empty language)}\]